

## ABSTRACT OF THE DISCLOSURE

A method for use in the fabrication of integrated circuits includes providing a substrate assembly having a surface. A diffusion barrier layer is formed over at least a portion of the surface. The diffusion barrier layer is formed of  $\text{RuSi}_x\text{O}_y$ , where  $x$  and  $y$  are in the range of about 0.01 to about 10. The barrier layer may be formed by depositing  $\text{RuSi}_x\text{O}_y$  by chemical vapor deposition, atomic layer deposition, or physical vapor deposition or the barrier layer may be formed by forming a layer of ruthenium or ruthenium oxide over a silicon[ ]-containing region and performing an anneal to form  $\text{RuSi}_x\text{O}_y$  from the layer of ruthenium and silicon from the adjacent silicon[ ]-containing region. Capacitor electrodes, interconnects or other structures may be formed with such a diffusion barrier layer. Semiconductor structures and devices can be formed to include diffusion barrier layers formed of  $\text{RuSi}_x\text{O}_y$ .